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Measuring Adolescent Smoking Expectancies by Incorporating Judgments About the Expected Time of Occurrence of Smoking Outcomes

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French and English Canadian adolescents completed a smoking expectancy questionnaire and 2 measures of current smoking status. Multiple regression revealed that beliefs about the expected time of occurrence of smoking outcomes explained unique variance in current smoking after controlling for judgments about the probability and desirability of these outcomes. In addition, the relationship between the perceived probability of the general costs of smoking and current smoking was moderated by beliefs about the expected time of occurrence of these costs. There was no relationship between perceived probability of general costs and smoking for adolescents who expected the costs to occur far in the future, whereas there was a significant negative relationship between these 2 variables for adolescents who expected the costs to occur soon after smoking. The authors' results suggest that it may be possible to increase the concurrent validity of traditional smoking expectancy measures by incorporating expected-time-of-occurrence judgments.

Keywords: adolescents, smoking expectancies, temporal discounting, decision making

Smoking cigarettes has been repeatedly singled out as one of the most significant preventable causes of mortality and morbidity in the United States (McGinnis & Froege, 1993; Russell, 1990). Despite the introduction of targeted laws and programs designed to reduce tobacco use among adolescents, smoking prevalence for this group remains high (Centers for Disease Control and Prevention, 1999). Given that experimentation with tobacco usually begins during adolescence (Orlando, Tucker, Ellickson, & Klein, 2004; Wills, Resko, Ainette, & Mendoza, 2004), and that once adolescents begin smoking they often find it difficult to stop, it is important to understand the determinants of smoking so that effective prevention and cessation interventions can be developed. In the current study, we contribute to this understanding by examining whether the concurrent validity of traditionally structured measures of smoking outcome expectancies can be improved by incorporating adolescents' beliefs about the expected time of occurrence (ETO) of smoking outcomes.

Outcome expectancies play a central role in many models of substance use (Hine, Summers, Tilleczek, & Lewko, 1997; Petraitis, Flay, & Miller, 1995) and have been consistently linked to smoking in both adolescents (e.g., Anderson, Pollak, & Wetter, 2002; Bauman & Chenoweth, 1984; Chassin, Presson, Sherman, Corty, & Olshavsky, 1984; Hine, McKenzie-Richer, Lewko, Tilleczek, & Perreault, 2002; Myers, McCarthy, MacPherson, & Brown, 2003) and adults (e.g., Brandon & Baker, 1991; Copeland, Brandon, & Quinn, 1995; Downey & Kilbey, 1995; Wetter et al., 1994; Wetter et al., 2004). A general finding in the literature just cited is that individuals who expect positive social and physiological consequences from smoking are more likely to begin and continue to smoke than individuals who expect less positive consequences. There is also evidence to suggest that smoking expectancies may mediate the effects of other potential causes, such as peer smoking, on adolescents' tobacco use decisions (Hine et al., 2002).

Several methods for operationalizing smoking expectancies have been reported in the literature. The three most common approaches define expectancies in terms of (a) perceived probability, (b) subjective expected utility (SEU), and (c) decomposed SEU judgments. For probability measures (e.g., Copeland et al., 1995; Myers et al., 2003; Wetter et al., 1994), respondents are provided with a list of potential smoking consequences, and they estimate the likelihood that each consequence will occur. In the SEU approach (e.g., Bauman & Chenoweth, 1984; Bauman, Fisher, & Koch, 1989; Brandon & Baker, 1991), respondents provide both probability and desirability estimates for a list of possible smoking consequences. These ratings are multiplied together and summed across items to generate a general utility index, or several consequence-specific subindexes, that can be used to predict smoking intentions, behavior, or both. The decomposed SEU approach (e.g., Copeland & Brandon, 2002; Evans, 1991; Hine et al., 2002) involves separating SEU into three components (probability, desirability, and a Probability $\times$ Desirability interaction) and testing each of these effects using hierarchical multiple regression.

Studies comparing the concurrent and predictive validity of these three measurement approaches suggest that, in general, expectancies operationalized as probability judgments are stronger predictors of smoking outcomes than SEU (Brandon & Baker, 1991; Copeland et al., 1995) and that decomposed SEU judgments are stronger predictors than probability ratings alone (Copeland &

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Brandon, 2002). In a related study that investigated whether expectancies mediate the effects of previous smoking, peer smoking, and parent smoking on current smoking, Hine et al. (2002) found that decomposed SEU exhibited superior mediational properties than SEU. They demonstrated that, relative to nondecomposed expectancy measures, decomposed measures were more strongly related to most of the independent and dependent variables included in the study, thus improving the chances of identifying significant mediational paths.

The primary goal of the current study was to determine whether the concurrent validity of decomposed smoking expectancy measures can be further improved by incorporating ratings of ETO of smoking outcomes. Research on temporal discounting indicates that consequences expected to occur immediately or soon after a choice is made typically exert a stronger effect on behavior than consequences expected to occur far in the future (Mischel, Grusec, & Masters, 1969; Rachlin, Raineri, & Cross, 1991; Stevenson, 1993). Discounting theory predicts that two individuals who provide identical probability or SEU ratings for a given smoking consequence may behave quite differently depending on when they expect the consequence to occur. This suggests that the addition of discounting information may improve the validity of traditional expectancy measures. Although most studies suggest that there are few important differences in the cognitive decision processes of adults and adolescents (e.g., Beyth-Marom, Austin, Fischhoff, Palmgren, & Quadrel, 1993; Quadrel, Fischhoff, & Davis, 1993), it could be argued that temporal discounting may be slightly more relevant to adolescents given that, on average, their objective time horizons (i.e., the amount of time in the future in which an event can possibly occur) are longer than those of adults. For example, assuming a life span of 65 years, a 15-year-old could discount possible outcomes 50 years into the future, whereas a 60-year-old could discount only 5 years.

Expected-time-of-occurrence judgments have the potential to enhance validity at least two ways: (a) as a main effect and (b) as a moderator of probability and desirability judgments. We predicted that, as a main effect, ETO will account for a significant amount of unique variance in respondents' smoking behavior over and above that accounted for by probability and desirability judgments. In regard to expected smoking costs, we expected the relationship between ETO and current smoking to be positive; that is, that respondents who believe smoking costs will occur far in the future are likely to smoke more than respondents who believe the costs will occur immediately or near in the future. For positive smoking outcomes (i.e., benefits), we predicted the opposite pattern, that respondents who believe benefits will occur far in the future will smoke less than those who believe benefits will be more immediate.

We also predicted that ETO judgments, in addition to operating as a main effect, will moderate the effects of probability and desirability judgments on current smoking behavior. In particular, we predicted that the magnitude of these effects will be weaker for outcomes expected to occur far in the future and stronger for outcomes expected to occur near in the future.

Method

Participants

Participants were 486 students attending six northern Ontario (Canada) public schools, the same sample used in Hine et al.'s (2002) study. The sample included a mix of never-smokers (28%), triers (26%), occasional smokers (10%), daily smokers (25%), and ex-smokers (11%). On average, respondents reported smoking 2.84 cigarettes per day ($SD = 5.12$). Ex-smokers were excluded from all subsequent analyses because "quitting smoking" has been found to be difficult to measure reliably in adolescent samples (Adlaf, Smart, & Walsh, 1993). An additional 33 respondents were deleted for excessive missing data (i.e., missing data on greater than 30% of the 152 variables used for the analyses in this study) or because they did not respond to either of the smoking behavior measures. For the remaining 409 cases, the percentage of missing data across items ranged from 0 to 6.90% ($M = 1.70$, $SD = 0.78$). Across participants, the percentage of items with missing data ranged from 0% to 13.80% ($M = 0.69$, $SD = 1.71$). All missing data were replaced by values imputed by SPSS's expectation maximization alogorithm.

Of the final sample, 53% of the participants were female and 47% were male. Twelve percent were in Grade 7, 12% were in Grade 8, 32% were in Grade 9, 14% were in Grade 10, 24% were in Grade 11, 6% were in Grade 12, and 1% were in Grade 13. Ages ranged from 12 to 19, with a mean of 14.79 years ($SD = 1.55$). Sixty-two percent attended French schools, and 38% attended English schools. French students completed a French language version of the questionnaire, and English students completed an English version. Two bilingual health professionals reviewed the questionnaires to ensure the meaning of the items was equivalent across the two versions. Minor revisions were made in response to feedback provided by the reviewers.

Procedure

The questionnaire consisted of 230 items (152 of which were used in the current study) assessing self-reported smoking status; smoking intentions; nicotine dependence; smoking expectancies; parents', siblings', and peers' smoking behavior; family dynamics; attitudes toward smoking; and several demographic variables. Questionnaires were completed in schools during class time in the presence of at least one member of the research team and one teacher. Participants were asked not to discuss their responses with their classmates. To encourage accurate responding, participants were told not to include their names on the questionnaire and that their individual (i.e., nonaggregated) responses would not be made available to either their teachers or parents. Previous research suggests that adolescents provide accurate self-reports of smoking behavior under conditions similar to those in the current study (Murray, O'Connell, Schmidt, & Perry, 1983).

Measures

Smoking expectancies. A new measure of adolescent smoking expectancies was developed for this study. The Smoking Consequences Questionnaire (Brandon & Baker, 1991) and the Decisional Balance Scale (Velicer, DiClemente, Prochaska, & Brandenburg, 1985), the two most commonly used measures in this area of research, were not considered suitable because they were developed using adult samples and thus underrepresent several key outcomes relevant to adolescents (e.g., peer relationships, conflicts with parents and teachers, and physical appearance). Bauman and Chenoweth's (1984) smoking consequences scale for adolescents was also considered but was rejected because it did not adequately address issues related to the control of weight and affect.

Our smoking expectancies measure was developed from open-ended interviews with 40 smokers and nonsmokers between the ages of 12 and 18 years, attending middle school and high school in northern Ontario. The interviews followed a recursive format similar to that used by Bostrom, Fischhoff, and Morgan (1992). Participants were asked to "list out all thoughts and images that come to mind in response to the phrase *smoking cigarettes*." After an initial list of concepts had been elicited, participants were asked to elaborate on each concept. If new concepts were identified during the elaboration phase, they were added to the end of the list. This process continued until the list was exhausted and no new concepts were forthcoming. The interview protocol was designed to maximize disclosure

while minimizing the imposition of the interviewer's perspective on the respondents.

Coding of the qualitative responses produced 12 general categories of smoking expectancies: (a) health, (b) addiction, (c) negative physical feelings, (d) social costs, (e) financial costs, (f) performance decrements, (g) physical appearance, (h) social benefits, (i) weight control, (j) negative affect control, (k) positive affect, and (l) negative affect. A panel consisting of the authors and two youth workers selected the best exemplars for each category using both responses from the interviews and existing expectancy measures. The item pool was further refined by having five adolescents review the measure to identify unclear or irrelevant items and make suggestions about other smoking consequences that should be included in the scale. The resulting expectancy measure consisted of 50 items, most of which were similar to items found in existing smoking expectancy scales (e.g., Bauman & Chenoweth, 1984; Brandon & Baker, 1991; Copeland et al., 1995; Velicer et al., 1985). However, it is important to note that the specific combination of items in our measure is unique; that is, none of the existing measures we reviewed provided satisfactory coverage of all of the 12 expectancy categories identified in our interviews.

For each of the expectancy items, participants were asked to:

> Circle the number that best corresponds to your beliefs about (1) the likelihood that the listed outcome will happen to you personally if you smoked cigarettes (1 = very unlikely, 2 = moderately unlikely, 3 = moderately likely, 4 = very likely), (2) how desirable you consider the outcome (1 = very undesirable, 2 = moderately undesirable, 3 = moderately desirable, and 4 very desirable),[1] and (3) when in the future you would expect the outcome to happen if you smoked (1 = immediately, 2 = near in the future, 3, far in the future, 4 = never).

The factor structure and psychometric properties of our smoking expectancy measure are reported in the Results section.

Current smoking. Respondents' current smoking behavior was measured by two items assessing smoking frequency and quantity. For smoking frequency, respondents were classified into four categories of smoking frequency based on their responses to a single item measure in which they were asked to describe their current smoking status: (a) nonsmokers, (b) triers (smoked only once or twice in their lives), (c) occasional smokers (smoke occasionally up to once or twice per week), and (d) daily smokers. These frequency categories are similar, but not identical, to those used by Brandon and Baker (1991). For smoking quantity, respondents were classified into one of seven categories following Health Canada guidelines (Mills, Stephens, & Wilkins, 1994): (a) 0, (b) 1–5, (c) 6–10, (d) 11–15, (e) 16–20, (f) 21–25, and (g) 26 + cigarettes per day. A composite measure, Current Smoking, was computed by standardizing and averaging the frequency and quantity measures ($\alpha = .88$).

Results

Exploratory Principal-Components Analysis

To determine the factor structure of our new smoking expectancy measure, we conducted an exploratory principal-components analysis on a 50 × 50 correlation matrix of the respondents' probability ratings for the smoking expectancy items. Velicer's (1976) Minimum Average Potential test indicated that six factors should be retained from the exploratory principal-components analysis. These components accounted for 50% of the overall response variance. The solution was rotated using the direct oblimin approach, with delta set to 0 to permit moderate correlations among the components. Items with pattern-matrix loadings of .55 or over and cross-loadings below .3 were retained to define each factor.

The first scale, labeled General Costs, consisted of 10 negative smoking consequences related to appearance, finance, sports performance, physiological discomfort, and addiction. Social Benefits, the second scale, included six items addressing social acceptance by peers and siblings. The third scale, Social Costs, consisted of four items related to the disapproval of significant others and decreased popularity. Health Costs, the fourth scale, consisted of four items related to the negative impact of smoking on physical well-being. The fifth scale, Weight Control, included four items related to weight loss and appetite suppression. The sixth and final scale, Affect Control, also included four items related to relaxation, stress reduction, and anger control. The items and loadings associated with each of these scales are presented in Table 1.

Overall, the solution exhibited good simple structure, with only one high-loading variable cross-loading above .3 on a second factor (the item "feel good" loaded on both Affect Control and Social Benefits). Items not loading above .55 on any of the factors included: get caught by parents, feel lethargic or unhealthy, feel anxious, lose sense of taste, feel more confident, increase probability of getting boyfriend/girlfriend, feel more independent, experience pleasure, be poor, lose respect of teachers, feel guilty, lose respect of parents, irritate others, look less attractive, and reduce anxiety or worry.

Scale Construction, Internal Consistencies, and Interscale Correlations

We computed expectancy subscale scores for probability, desirability, and ETO separately by averaging the items that defined each factor in the initial exploratory factor analysis (see Table 1). Cronbach's alphas ranged from .73 to .90 for the probability subscales, .75 to .93 for desirability, and .74 to .90 for ETO. A complete listing of the internal consistencies can be found in Table 2.

Examination of the correlations among probability, desirability, and ETO for each of the expectancy subscales revealed several interesting patterns. First, for all subscales the correlations between probability and ETO were negative and moderate to large in magnitude, ranging from −.48 for Health Costs to −.68 for Affect Control ($M_r = -.59$).[2] Thus, outcomes that were anticipated to occur near in the future were perceived to be more probable than outcomes anticipated to occur far in future. Second, the magnitude of the correlations between desirability and ETO varied depending on whether the subscale assessed costs or benefits. For the benefits subscales, the correlations were negative and moderate in magnitude ($M_r = -.46$, range = −.39 for Social Benefits to −.51 for Weight Control), indicating the benefits that were expected to occur in the nearer term were viewed as more desirable than longer term benefits. For the costs subscales, this effect was much weaker ($M_r = -.18$, range = −.08 for General Costs to −.26 for Health Costs). A similar pattern emerged for the probability−desirability correlations. For benefits, the correlations between probability and

[1] The desirability scale was recoded prior to computing SEU scores for each consequence such that consequences that were perceived to be undesirable were given negative scores and consequences that were perceived to be desirable were give positive scores (–1.5 = *very undesirable*, –0.5 = *moderately undesirable*, 0.5 = *moderately desirable*, and 1.5 = *very desirable*).

[2] As recommended by Rosenthal and Rosnow (1991), all correlations were transformed to Fisher's *Zr* prior to averaging and then retransformed back *r* following averaging.

desirability were all positive and consistently fell in the moderate to strong range (M_r = .48, range = .39 for Social Benefits to .61 for Affect Control); that is, respondents consistently perceived probable benefits to be more desirable than improbable benefits. For the costs subscales, the correlations between probability and desirability were much weaker (M_r = .14), and the direction varied depending on the specific subscale involved (range = −.03 for General Costs to .22 for Social Costs).

Concurrent Validity

To examine the relationship between ETO judgments and smoking, we conducted a multiple regression analysis with the six ETO subscales as predictors and current smoking as the dependent variable. The analysis, summarized in Table 3, revealed that three of the subscales (General Costs, Social Costs, and Affect Control) were significant predictors. Consistent with our predictions, respondents who expected social costs to occur further in the future smoked more than those who expected these costs to occur nearer in the future. Also as predicted, respondents who expected affect control benefits to occur nearer in the future smoked more than respondents who expected affect control to occur further in the future. Counter to our predictions, respondents who expected general costs related to smoking to occur sooner smoked more than those who expected these costs to occur further in the future. We provide an explanation for this anomalous result in the Discussion section. Overall, the six ETO subscales accounted for 26% of the variance in Current Smoking ($p < .001$, adjusted [adj.] $R^2 = .25$).

Examination of the residuals for this analysis revealed no evidence of nonlinearity, heteroscedasticity, or sequential dependence (Durbin–Watson = 1.78). A histogram of the residuals revealed a mild positive skew, violating the normality assumption. A reanalysis using a log transformed version of current smoking corrected the skewness problem and produced the same substantive results as the original analysis.

To determine first if the concurrent validity of traditional smoking expectancy measures could be improved by including information about ETO of smoking outcomes, and second if desirability and ETO moderated the relationship between probability ratings and current smoking, we conducted a five-step hierarchical multiple regression analysis with current smoking as the dependent variable. In Step 1, the probability ratings for all six smoking expectancy subscales were entered. Desirability ratings for the expectancy subscales were entered in Step 2, and ETO ratings were entered in Step 3. The products of the probability and

Table 1
Exploratory Principal Components Analysis: Component Scales, Items, and Loadings for Smoking Expectancy Probability Measure

Factor scale and item	Loading
Factor 1: General costs	
Stained fingers and teeth	.82
Bad breath	.73
Less spending money	.70
Bad taste in mouth	.68
Smell bad	.67
Hurt lungs	.62
Perform less well at sports	.62
Become dependent on nicotine	.59
Get hooked	.59
Damage health of others	.58
Factor 2: Social benefits	
Look cool	.69
Fit in better with friends	.69
Look more attractive	.67
Gain respect of friends	.61
Increase your status	.60
Gain respect of brother(s) and/or sister(s)	.56
Factor 3: Social costs	
Become less popular	.76
Lose respect of friends	.71
Feel like an outsider	.69
Lose respect of brother(s) and/or sister(s)	.56
Factor 4: Health costs	
Get heart disease	.83
Get lung cancer	.82
Seriously damage your health	.78
Die prematurely	.59
Factor 5: Weight control	
Control your appetite	.79
Control your weight	.78
Prevent overeating	.69
Prevent weight gain	.60
Factor 6: Affect control	
Feel less stressed	.73
Relax	.70
Control or reduce anger	.68
Feel calm	.65

Note. Following the recommendations of Tabachnick and Fidell (2001), pattern matrix loadings following the oblimin rotation are reported. These values are partial correlations between the scale items and the factors, after controlling for the variance shared by the other retained factors.

Table 2
Internal Consistencies for the Probability, Desirability, and Expected-Time-of-Occurrence Smoking Expectancy Subscales

	Judgment type		
Subscale	Probability	Desirability	Expected time of occurrence
General costs	.90	.93	.90
Social benefits	.77	.84	.80
Social costs	.73	.78	.81
Weight control	.77	.75	.74
Health costs	.86	.86	.81
Affect control	.79	.80	.79

Note. Values in the table are Cronbach's alpha.

Table 3
Summary of Regression Analysis Examining the Relationship Between Expected-Time-of-Occurrence (ETO) Subscales and Current Smoking

ETO subscale	r	β	sr^2
General costs	−.11*	−.19*	.02*
Social benefits	−.06	.04	.00
Social costs	.28**	.38**	.10**
Weight control	−.19**	−.09	.01
Health costs	.01	.03	.00
Affect control	−.37**	−.34**	.07**

Note. r = zero-order correlation; sr^2 = squared semi-partial correlation. * $p < .05$. ** $p < .01$.

desirability, probability and ETO, and desirability and ETO ratings for all subscales were entered in Step 4, and three-way interaction cross-products for all subscales were entered in Step 5. Following the recommendations of Cohen, Cohen, West, and Aiken (2003), all main effects were centered prior to computing the interaction terms. To strike a balance between making Type I and Type II errors, given the large number of significance tests computed, a conservative alpha level of .01 was adopted for all tests of individual beta coefficients. All assumptions for regression analysis were met. The residuals from the analysis were normally distributed and homoscedastic. There was no evidence of nonlinear relationships among the variables, and the Durbin–Watson statistic was 2.08, suggesting no problem with sequential dependence. A summary of the analysis is provided in Table 4.

Table 4
Summary of Regression Analysis Examining Whether Expected-Time-of-Occurrence (ETO) Subscales Improve the Concurrent Validity of Traditional Probability and Desirability Expectancy Measures

Expectancy scale and rating	Step 1	Step 2	Step 3	Step 4
Probability				
General costs	−.03	−.04	−.14	−.05
Social benefits	−.14**	−.13	−.15	−.16**
Social costs	−.39***	−.33***	−.24***	−.32***
Weight control	.06	−.01	.04	.04
Health costs	.12	.10	.09	.18
Affect control	.45***	.42***	.37***	.35***
Desirability				
General costs		.05	.04	.02
Social benefits		−.08	−.11	−.09
Social costs		−.15**	−.15**	−.16**
Weight control		.15**	.16**	.19**
Health costs		.09	.09	.06
Affect control		.04	.08	.04
General costs			−.20**	.12
Social benefits			−.08	−.09
Social costs			.13	−.04
Weight control			.08	.11
Health costs			.04	.02
Affect control			−.02	−.03
Probability × Desirability				
General costs				.25
Social benefits				.00
Social costs				−.09
Weight control				.00
Health costs				.12
Affect control				.04
Probability × ETO				
General costs				.28***
Social benefits				.01
Social costs				−.14
Weight control				−.03
Health costs				.06
Affect control				−.02
Desirability × ETO				
General costs				.32
Social benefits				−.03
Social costs				−.20
Weight control				.09
Health costs				−.08
Affect control				.04

Note. The dependent variable for this analysis was current smoking. Numbers in the table are standardized beta coefficients.
** $p < .01$. *** $p < .001$.

In Step 1, the six probability ratings explained a significant amount of variance in current smoking, $F(6, 402) = 39.46$, $p < .001$, $R^2 = .37$, adj. $R^2 = .36$, with the scales related to Social Costs, Affect Control, and Social Benefits making the strongest individual contributions. The addition of the desirability ratings in Step 2 resulted in a significant increase in R^2, $F_{\text{Change}}(6, 396) = 2.97$, $p < .01$, $R^2 = .40$, adj. $R^2 = .38$, $\Delta R^2 = .03$, with Social Costs and Weight Control making significant individual contributions. The prediction of current smoking was further improved by the inclusion of the ETO ratings in Step 3, $F_{\text{Change}}(6, 390) = 2.15$, $p < .05$, $R^2 = .42$, adj. $R^2 = .39$, $\Delta R^2 = .02$. General Costs was the only ETO subscale to make a significant unique contribution to the prediction equation after controlling for the other predictors.

The two-way interactions among the probability, desirability, and ETO scales entered in Step 4 also accounted for a significant amount of additional variance in current smoking, $F_{\text{Change}}(18, 372) = 2.85$, $p < .001$, $R^2 = .49$, adj. $R^2 = .44$, $\Delta R^2 = .07$. Examination of the standardized beta coefficients for the individual effects revealed one significant interaction between perceived probability of general costs and ETO of general costs. To interpret the interaction, we plotted the relationship between perceived probability of general costs at three levels of ETO: (a) one standard deviation below the mean, (b) at the mean, and (c) one standard deviation above the mean, following the procedures outlined in Cohen et al. (2003). Simple slope analyses revealed that perceived probability of general costs was unrelated to current smoking for respondents who expected general costs to occur far in the future ($B = -.06$, *ns*), moderately related to current smoking for respondents who expected general costs to occur a moderate time in the future ($B = -.26$, $p < .001$), and most strongly related to current smoking for respondents who expected general costs to occur near in the future ($B = -.45$, $p < .001$). For the last two groups, respondents who perceived general costs to be more probable smoked less than those who perceived these costs to be less probable.

The three-way interactions added to the regression equation in Step 6 failed to account for additional variance in current smoking, $F_{\text{Change}}(6, 366) = 0.53$, *ns*, $R^2 = .49$, adj. $R^2 = .43$, $\Delta R^2 = .00$, and therefore were not interpreted.

Discussion

Many current models of smoking expectancies suggest that decisions about initiating, continuing, and quitting smoking are influenced by two types of cognitions: judgments about the probability of smoking outcomes and judgments about the desirability of these outcomes. Temporal discounting theory (Mischel et al., 1969; Rachlin et al., 1991; Stevenson, 1993) suggests that a third cognitive variable, expected time of occurrence of smoking outcomes, may also play an important role. The primary aim of this study was to determine whether ETO judgments were significantly related with smoking behavior and, if so, whether the concurrent validity of traditional smoking expectancy measures could be improved by incorporating such judgments.

We found three of the six ETO subscales examined in this study (General Costs, Social Costs, and Affect Control) to be significant predictors of current smoking. As predicted, respondents who believed that social costs would occur further in future smoked more than those who expected these costs to be more immediate. Also as predicted, the opposite pattern was observed for affect

control: Participants who expected benefits associated with affect control to occur soon after cigarette use smoked more than those who expected the benefits to occur more distally. Counter to our predictions, respondents who expected general costs of smoking to occur sooner smoked more than those who expected these costs to occur later. A possible explanation for this unexpected effect is that many of the smokers in our sample had firsthand experiences with at least some of the negative smoking outcomes included in our General Costs subscale (e.g., addiction, stained fingers and teeth, bad breath, decrements in sport performance, etc.). These experiences may have taught them that these costs sometimes occur more rapidly than the average nonsmoker might suspect.

Our prediction that the inclusion of ETO subscales would improve the concurrent validity of traditional smoking expectancy measures was also supported. The ETO subscales, taken as a set, accounted for a significant amount of additional variance in current smoking after statistically controlling for demographics and respondents' perceptions about the probability and desirability of smoking outcomes. However, the overall improvement in the prediction, although statistically significant, was only modest in magnitude, and only one of the six ETO subscales (General Costs) accounted for a significant amount of unique variance in current smoking after controlling for the other predictors in the model.

We also explored the possibility that ETO subscales might improve the concurrent validity of traditional expectancy measures by moderating the effects of probability and desirability judgments on smoking behavior. A significant interaction between perceived probability and expected time of occurrence of General Costs provided support for this proposition. Respondents' probability judgments about expected costs significantly predicted smoking behavior only when these costs were expected to occur in the near to moderate future. When general costs were expected further in the future, the relationship between probability judgments and smoking was no longer significant.

Overall, our findings are consistent with the proposition that adolescents may implicitly or explicitly take into account information about ETO when making smoking decisions. However, it is important to keep in mind that the presence of an association between ETO judgments and smoking does not necessarily imply that the two variables are causally linked. It is possible that other uncontrolled variables may account for the associations observed in this study. It is also possible, as implied earlier, that the flow of causality runs from smoking to expectancies rather than, as implied by many decision models, from expectancies to smoking. Indeed, many researchers now appear to favor models of reciprocal causation in which expectancies influence behavior, which in turn influences expectancies (Bauman, Fisher, Bryan, & Chenoweth, 1984; Gerrard, Gibbons, Benthin, & Hessling, 1996). Longitudinal and experimental studies are required before stronger inferences regarding causal role of expectancies can be confidently drawn (Brandon, Juliano, & Copeland, 1999).

Although the results of this study are promising in several respects, we believe it is too early to recommend that traditional smoking expectancy measures be expanded to incorporate ETO judgments. The modest gains in concurrent validity observed in the current study are partially offset by losses in model parsimony. Whether this trade-off between improved validity and parsimony represents an overall net gain in our understanding and ability to predict smoking outcomes cannot be answered definitively at this time. Future research is needed to determine whether the results reported here can be replicated and perhaps improved on using more refined measures, different samples, and a broader range of smoking-related outcome variables.

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